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The tripartite Life of St. Patrick tells us that "St. Patrick himself here founded a monastery, and placed over it his honoured disciple Justus." Tradition has it that here were both a monastery and a nunnery, celebrated for the sanctity of their inhabitants; and that they so continued up to 1641, when Robin Ormsby, of Tobarvaddy (Ꞇobaꞃ a maꝺaıġ ("the Wolf's Well"), one of Coote's most active lieutenants, and who was usually called Rıbbeꞃꞇ na Ꝿlıꝿꝿeıꞃċa, or Jingling Robert, from the clattering of his coat of mail and his horse trappings, expelled the monks and nuns, and levelled the ancient structures to the ground, and verily left not one stone upon another! so that these two stones alone remain to testify that they once were there.

Whether I may be right in my guess as to the date, or not, it is certain that these stones are not the production of modern times; and they combine to prove the same fact, that many celebrated for their sanctity once dwelt here, and were interred in Fuerty church-yard.

Dr. Petrie made some remarks in explanation, and gave a different reading and analysis of the inscriptions. Reference being made to Dr. Stokes regarding the representation of a fish on one of these stones, he observed that, in a recent visit to Prague, he found this symbol very prevalent on the tombstones of the Jewish cemetery in that city.

The Academy then adjourned.

## MONDAY, JANUARY 11, 1864.

The VERY REV. CHARLES GRAVES, D. D., President, in the Chair.

The Right Hon. the Earl of Charlemont; Right Hon. the Earl of Donoughmore; Charles H. Foot, B. A.; G. Charles Garnett, B. A.; J. J. Digges La Touche, B. A.; and Major Robert Poore; were elected members of the Academy.

Edward Blythe, Esq. (with the permission of the Academy), read a paper "On the existing Species of Stag (*Elaphus*)."

The REV. SAMUEL HAUGHTON, M. D., Fellow of Trinity College, Dublin, read the following paper:—

### NOTES ON ANIMAL MECHANICS.

### No. I.—*On the Muscular Mechanism of the Hip Joint in Man.*

*Introduction.*—In the course of the following notes on the muscular mechanism of the joints in man and other animals, I shall have occasion to use certain principles, or postulates as I prefer to call them, which are not as yet employed generally by anatomical writers; and for this reason I shall here give a few words of explanation respecting them.

These postulates are two in number, and are as follows:—

*Postulate* 1.—That the amount of Work done by a muscle in a given time is proportional to its weight; *i. e.*, to the number of muscular fibres in contraction.

*Postulate* 2.—That the mean lengths of the different muscles employed at each joint are proportional to the perpendiculars let fall from the centre of motion of the joint upon the directions in which the muscles act.

In the statement of the first postulate there is, of course, a slight error, arising from the different amounts of cellular tissue and fascia entering into the composition of each muscle; this, however, only introduces an error proportional to the differences of the cellular tissue and fascia in the different muscles, which may be regarded as small. So far as my experiments have led me, I incline to the opinion, that such muscles as the heart and psoas, composed nearly altogether of muscular fibre of fine texture, are capable of giving out their work for a longer time than muscles of an opposite character, such as the glutæus maximus and deltoid; but that for an interval of time less than that requisite to produce fatigue, the work given out is the same for both classes of muscles, within small limits.

The reasonableness of the second postulate may be shown from the following considerations:—

1. The distance through which the point of application of a muscle is moved by its contraction is proportional to the mean length of the muscle.

2. It is geometrically evident that the perpendiculars let fall on the directions of the muscles are proportional to the spaces moved through by their points of application.

3. The Divine Contriver of the joint has made a perfect mechanism, and therefore employs a minimum expenditure of force.

If the third of these considerations be admitted, *Postulate* 2 follows from the first two considerations; for otherwise there would occur a waste of force, some of the muscles having ceased to act before the others had expanded their store of force.

Professor Donders, of Utrecht, has indeed proved, by direct measurement, that the lengths of the muscles acting on the human elbow are nearly proportional to the distances of their points of application from the joint; and I believe that he would have found a still more exact agreement, if he had used the perpendiculars instead of the distances. The following corollary follows from the two postulates employed:—

*Corollary* 1.—The moment of each muscle, with respect to the centre of the joint, is proportional to its weight.

Let $F$ be the force of the muscle, $p$ the perpendicular let fall upon its direction from the centre of the joint, $x$ the space through which the muscle contracts, and $l$ its mean length.

The work done by the muscle is $Fx$, which is proportional to $Fl$, and therefore to $Fp$, by the second postulate; but $Fx$ is also proportional to the weight of the muscle, by the first postulate; and therefore $Fp$, which is the moment of the muscle with respect to the centre of the joint, is also proportional to its weight.—Q. E. D. Hence it follows that—

*Corollary* 2.—The weights of the muscles surrounding the joint may be regarded as moments of the forces, and may therefore be compounded by the law of composition of moments or couples.

The action of the muscles that move the thigh upon the hip is usually referred by anatomists to three classes of motion:—

*a.* Rotation outwards or inwards.
*b.* Flexion or extension.
*c.* Abduction or adduction.

If we imagine three rectangular co-ordinates drawn at the centre of the acetabulum in the following manner:—

*a.* Vertical axis,
*b.* Horizontal lateral axis,
*c.* Horizontal antero-posteral axis;

it is easy to see that rotation round these axes corresponds with the three recognised classes of motions; and as every motion, however complex, of the thigh upon the hip, must be a rotation round some diameter of the sphere of which the acetabulum forms a portion, it is evident that every such motion may be interpreted correctly in the usual way, by the aid of the composition of rotations.

Such a method of interpretation, although exact, is not simple, as the axes of co-ordinates are not chosen with reference to the forces and directions of the muscles themselves, but with reference to directions, vertical and horizontal, arbitrarily assumed beforehand.

In the following note I shall endeavour to establish the existence of three axes of co-ordinates, to which the motions of the hip joint may be referred, and which possess not only greater simplicity than other systems of axes, but also other properties of great interest and importance.

The centre of the acetabulum is the centre of motion of the thigh upon the hip; and the centre of motion of the body upon the pelvis is situated in the junction of the fifth lumbar vertebra with the sacrum. If these two centres of motion be joined, we have a geometrical line to which the motions of the hip joint ought to be referred. In the erect posture in man, this line is the axis of the neck of the femur, and is essentially an oblique line, making acute angles with all the three axes of anatomical writers.

The anatomical and mechanical problem which I propose to solve is the following:—

"To find the simplest planes passing through the centres of motion of the body on the pelvis, and of the hip on the thigh, to which the forces of the muscles of the hip joint can be referred."

I shall commence by recording the observations made upon a human subject, which was a female, aged 40, weight 82 lbs., and height $65\frac{1}{4}$ inches. I selected a female subject, in consequence of my first comparative dissections having been made on a female Cercopithecus.

The weights of the body, viscera, and muscles of this subject were found to be as follow:—

## TABLE I.—*Physical Data* (*Woman*).

### (*a*) *Body and Viscera.*

| | | |
|---|---|---|
| 1. Body, | 82 lbs. | 1312 oz. av. |
| 2. Brain, | | 53¾ ,, |
| 3. Heart, | | 7¼ ,, |
| 4. Right Kidney,* | 7¼ oz. | 16¼ ,, |
| 5. Left Kidney,* | 9 ,, | |
| 6. Liver,* | | 119¼ ,, |
| 7. Spleen, | | 7¼ ,, |

### (*b*) *Posterior Muscles of Hip Joint.*

| | | |
|---|---|---|
| 1. Glutæus maximus, | 11½ oz. | 21¾ oz. |
| 2. Glutæus medius, | 7½ ,, | |
| 3. Glutæus minimus, | 2¾ ,, | |

### (*c*) *Anterior Muscles of Hip Joint.*

| | | |
|---|---|---|
| 1. Iliacus, | 2¾ oz. | 21 oz. |
| 2. Psoas magnus, | 1½ ,, | |
| 3. Psoas parvus,† | 0¼ ,, | |
| 4. Pectinæus, | 0¾ ,, | |
| 5. Adductor longus, | 1¾ ,, | |
| 6. Adductor brevis, | 1¼ ,, | |
| 7. Adductor magnus, | 11¾ ,, | |
| 8. Gracilis, | 1 ,, | |
| 9. Sartorius, | 2¼ ,, | |
| 10. Tensor vaginæ femoris, | 1½ ,, | |

### (*d*) *Flexors of the Knee Joint.*

| | |
|---|---|
| 1. Biceps femoris, | 3¼ oz. |
| 2. Semi-tendinosus, | 1¼ ,, |
| 3. Semi-membranosus, | 2¾ ,, |

### (*e*) *Extensors of the Knee Joint.*

| | |
|---|---|
| 1. Rectus femoris, | 2¾ oz. |
| 2. Triceps extensor,<br>(viz., vastus externus, internus, and cruræus.) | 17 ,, |

### (*f*) *Rotators of Hip Joint.*

| | |
|---|---|
| 1. Pyriformis, | 1 oz. |
| 2. Obturator externus, | 0¾ ,, |

### (*g*)

| | |
|---|---|
| Quadratus lumborum, | 0⅔ oz. |

---

* Both kidneys were fatty, and the liver was fatty and enlarged.

† I have placed this muscle among the muscles of the hip joint, because the connexion of its tendon with the *fascia iliaca* enables it to modify the action of the *m. iliacus.*

### (*h*) *Muscles of the Leg and Foot.*

| | | | |
|---|---|---|---|
| 1. | Gastrocnemius, | $3\frac{1}{4}$ | oz. |
| 2. | Plantaris, | $0\frac{1}{8}$ | ,, |
| 3. | Solæus, | $5\frac{1}{2}$ | ,, |
| 4. | Poplitæus, | $0\frac{1}{2}$ | ,, |
| 5. | Peronæus longus et brevis, | $1\frac{1}{4}$ | ,, |
| 6. | Flexor proprius hallicis, | $0\frac{3}{4}$ | ,, |
| 7. | Tibialis posticus, | $1\frac{2}{3}$ | ,, |
| 8. | Flexor communis digitorum, | $0\frac{1}{4}$ | ,, |
| 9. | Tibialis anticus, | $1\frac{1}{3}$ | ,, |
| 10. | Extensor communis digitorum, et perinæus tertius, | $0\frac{4}{5}$ | ,, |
| 11. | Extensor proprius hallicis, | $0\frac{1}{4}$ | ,, |

### *Posterior Muscles of Hip Joint.*

The posterior muscles, or *glutæi*, act on the hip joint in the manner represented in the annexed diagram (Fig. 1), which shows the innominate bone of the left side.

Fig. 1.

The *glutæus maximus* produces a rotation round the centre of the acetabulum in a plane passing through the line *a*; the *glutæus medius* in a plane passing through *b*; and the *glutæus minimus* in a plane through *c*.

The angle between *a* and *b*, measured at the centre of the sphere, is 49°; and the angle between *a* and *c* is 64°.

Taking the moments of the three muscles, with respect to the centre of the sphere, we find, by corollary 2, the resultant of all supposed to be in action together, as follows:—Measuring $X$ along *a*, and $Y$ at right angles to it, we obtain—

$$\begin{aligned} X &= 11{\cdot}5 + 7{\cdot}5 \cos 49^\circ + 2{\cdot}75 \cos 64^\circ, \\ Y &= \phantom{11{\cdot}5 + {}} 7{\cdot}5 \sin 49^\circ + 2{\cdot}75 \sin 64^\circ; \end{aligned}$$

from which follows,

$$X = 17{\cdot}62 \text{ oz.}$$
$$Y = 8{\cdot}15 \text{ oz.}$$

and

$$\sqrt{X^2 + Y^2} = 19{\cdot}41 \text{ oz.}$$

$$\frac{Y}{X} = 0{\cdot}4625 = \tan\,(24^\circ\ 49').$$

The resultant direction of the moment of the glutæal muscles is represented by the line *yx*, which nearly coincides with the ilio-pectinæal ridge, and lies somewhat inside a tangent plane from the centre of the acetabulum to the greater ischiadic notch.*

The resultant plane *xy* passes through the body of the 5th lumbar vertebra, and between the spinous processes of that vertebra and the first sacral vertebra.

### *Anterior Muscles of Hip Joint.*

The first eight of the ten anterior muscles have the following action:—

| | |
|---|---|
| 1. Iliacus, . . . . . . . . . . | 4½ oz. |
| 2. Psoas magnus, . . . . . . . | |
| 3. Psoas parvus, . . . . . . . . | |

move the head of the femur in the plane *a′*, which is found to be the prolongation of the diameter *a*; and their action therefore is directly the opposite of that of the *glutæus maximus.*

| | |
|---|---|
| 4. Pectinæus, . . . . . . . . . | 2¼ oz. |
| 5. Adductor longus, . . . . . | |

move the head of the femur in the plane containing the ilio-pectinæal ridge, or very nearly in the plane of the resultant moment of the *glutæi* muscles.

| | |
|---|---|
| 6. Adductor magnus, . . . . . | 13 oz. |
| 7. Adductor brevis, . . . . . . | |

produce motion alone the line *b′*, which is opposite to *b*, the direction of the *glutæus medius.* And, lastly, the

| | |
|---|---|
| 8. Gracilis, . . . . . . . . . | 1 oz. |

moves the head of the femur in the plane *c′*, opposite to *c*, the direction of the *glutæus minimus.*

---

* It was through this notch that Meriones was in the habit of piercing the bladders of his flying enemies; Il. E. 65-68, and Il. N. 650-655; and the bone mentioned is the *ilium*, and not the *pubes*, as the commentators suppose. It is very possible that Homer may have seen such a wound inflicted through the buttock, for his description of the wounded man, wriggling on the ground like a worm, after the division of the sciatic nerve, could only have occurred to an eye-witness.

Compounding the moments of these muscles as before, and using the line *aa'* as our origin of $X$, we obtain

$$X = 4\tfrac{1}{2} + 2\tfrac{1}{2}\cos 25^\circ + 13\cos 49^\circ + \cos 64^\circ$$
$$Y = 2\tfrac{1}{2}\sin 25^\circ + 13\sin 49^\circ + \sin 64^\circ$$
$$\sqrt{X^2+Y^2} = 19{\cdot}89 \text{ ozs.}$$
$$\frac{Y}{X} = \tan\,(36^\circ\ 47').$$

The close agreement in magnitude between the resultant moment of these muscles (19·89) and that of the *glutæi* (19·41) is very remarkable; and the difference of angle between them (11° 58′) is not more than might have been anticipated from unavoidable errors of observation.

The resultant plane of the anterior muscles is shown in the figure by the line $x'y'$. The bisector of the angle between the lines $xy$ and $x'y'$ is a tangent to the ischiadic notch, and coincides with the ilio-pectinæal ridge.

The diametral plane of the acetabulum just found, containing the ilio-pectinæal ridge, and touching the ischiadic notch, possesses many remarkable properties.

1st. It passes through the centre of the anterior line of junction of the fifth lumbar and first sacral vertebræ; i. e. through the centre of motion of the body on the pelvis.

2nd. It gives, both as respects distribution of matter and geometrical form, the section of the pelvis, which offers the *maximum* resistance to forces acting from the outside.

3rd. It is the plane of the resultant moment of the muscular forces acting on the hip joint, both with respect to the posterior and anterior muscles.

This plane may be called the ilio-pectinæal plane, and is the plane of maximum moments acting on the hip joint.

### *Remaining Muscles of the Hip Joint.*

In addition to the eleven muscles whose action has been already considered, there are six others which act upon the hip joint. They all act upon the joint so as to cause it to rotate upon the head of the femur in a plane at right angles to that already found to be that of the resultant moment of the posterior and anterior muscles. This plane passes through the tuberosity of the ischium, and falls just inside the anterior rim of the ilium. Three of the muscles in question act on one side, and three on the other side of the centre of motion, and in the erect posture their moments on the head of the femur are balanced. They may be called the ischiac and iliac muscles, with reference to their action on the hip.

### *Ischiac Muscles* (flexors of knee).

| | |
|---|---|
| 1. Biceps femoris (part), . . . . | 7¼ ozs. |
| 2. Semi-tendinosus, . . . . . . | |
| 3. Semi-membranosus, . . . . . | |

*Iliac Muscles* (extensors of knee in part).

1. Tensor vaginæ femoris, . . .
2. Sartorius,. . . . . . . . . .
3 Rectus femoris, . . . . . .

} 6½ ozs.

The resultant plane of the portion of the *biceps* attached to the ischium, and of the two internal hamstring muscles, is at right angles to the ilio-pectinæal plane; and the resultant of the action of the *tensor vaginæ* and of the *sartorius* coincides with the plane of the *rectus*, and also is at right angles to the ilio-pectinæal plane. Considering that only a portion of the *biceps* acts on the hip, and that in the erect posture the leverage of these muscles on the head of the femur is equal and opposite, it is manifest that these two groups of muscles, as well as the posterior and anterior groups, balance each other's action. This plane of resultant moments may be called the ilio-ischial plane. It is at right angles to the ilio-pectinæal plane, and intersects it along the line joining the centre of the sacro-lumbar articulation with the centre of the acetabulum—that is to say, the line joining the centre of motion of the body on the pelvis with the centre of motion of the hip upon the thigh.

In the erect posture, neither of these planes is vertical, and the diameters of the acetabulum corresponding to them make angles of about 45° at each side of the vertical diameter.

The ilio-ischial plane makes a section of the os innominatum, not so strong as that made by the ilio-pectinæal plane; and its curvature is in the opposite direction, being slightly concave outwards, while the curvature of the ilio-pectinæal section is strongly convex outwards. From this and other considerations, it follows that the ilio-ischial plane has relation rather to the support of the weight of the body than to resistance to forces acting from without.

Fig. 2.

The above figure represents the os innominatum of the right side, drawn from a point of view situated on the line joining the sacro-lumbar articulation with the centre of the acetabulum, and therefore shows the traces of the ilio-pectinæal and ilio-ischial planes as two right lines intersecting at an angle of 90°.

The Fig. 3 shows the section of the os innominatum made by the ilio-pectinæal plane, in which, as I have shown, the resultant couples of the principal muscles acting on the hip joint are situated. The cancellated portion of the bone is shaded, and the dense part is left white.

It would require a separate paper to show how admirably adapted this form of section is either to resist a shock acting in the direction of the arrow, which the bone receives in jumping down from a height on one foot, or to counteract the strain produced by the muscles acting from the periphery of the bone upon the femur.

Fig. 3.

In Fig. 4 I have shown the section of the os innominatum made by the ilio-ischial plane, at right angles to the ilio-pectinæal plane.

This section of the bone is rarely called upon to resist any strain in a transverse direction; and when the cavity of the acetabulum is completely filled by the head of the femur, its strength to resist vertical pressure, as in sitting, is very great.

Some interesting deductions may be made from the weights of the muscles, classified into groups suggested by the preceding analysis.

The total weight of the muscles of the hip and knee joints, named *b*, *c*, *d*, *e*, is found to be 73·50 oz.; of this amount 21·75 oz. are included in the three *glutæi*; 21 oz. in the group of eight muscles antagonistic to the *glutæi;* 23·5 oz. in the extensors of the knee (including the *tensor vaginæ*, which aids the *quadriceps extensor*); and 7·25 oz. are included in the flexors of the knee joint.

Expressed in percentages of the hip and knee joint muscles, these groups have the following values:—

Fig. 4.

| | Percentage. |
|---|---|
| 1. Posterior muscles of hip joint, | 29·6 |
| 2. Anterior muscles of hip joint, | 28·6 |
| 3. Extensors of knee joint, | 31·9 |
| 4. Flexors of knee joint, | 9·9 |
| | 100·0 |

The first three groups of muscles are here of nearly equal force, while the fourth is about a third of each of the first three.

## No. II.—*On the Muscles of some of the smaller Monkeys of the Genera Cercopithecus and Macacus.*

The first monkey whose muscular anatomy I shall describe was a female, of the genus *Cercopithecus*, which died in the Zoological Gardens of Dublin, in 1860.

The dissection of this animal gave me the following results:—

### Table II.—*Physical data. Cercopithecus* (female).

#### (*a*) *Body and Viscera.*

| | Grains. | | Grains. |
|---|---|---|---|
| 1. Body, | 34,390 | 4. Spleen, | 85 |
| 2. Brain, | 921 | 5. Kidneys, | 299 |
| 3. Liver, | 1422 | 6. Heart, | 210 |

#### (*b*) *Muscular System.*

| | Grains. |
|---|---|
| 1. Psoas magnus, | 145 |
| 2. Psoas parvus, | 45 |
| 3. Iliacus, | 70 |
| 4. Quadratus lumborum, and Sacrolumbalis, } (not separable,) | 419 |
| 5. Lumbo caudalis, (arises from (1 – 5) lumbar vertebræ, and is inserted into upper third of tail.) | 165 |
| 6. Longissimus dorsi (spliced into last), | — |
| 7. Glutæi and pyriformis, | 638 |
| 8. Quadriceps extensor femoris, | 628 |
| 9. Biceps, semimembranosus, semitendinosus, and gracilis, | 697 |
| 10. Adductores femoris, | 478 |
| 11. Trapezius, | 90 |
| *12. Accessory slip from the semicircular ridge of the occiput to the superior posterior angle of the scapula, | 15 |
| 13. Rhomboidei, | 35 |
| 14. Latissimus dorsi, (attached to triceps). | 219 |
| *15. Levator anguli scapulæ, (part of the serratus magnus, attached to the transverse process of 2 – 7 cervical vertebræ.) | 30 |
| *16. Levator acromio-trachelius of Cuvier? (from transverse spine of first vertebra to anterior third of the spine of the scapula), | 23 |
| 17. Sterno-cleido-mastoid, | 50 |
| 18. Pectorales, | 224 |

| | Grains. |
|---|---|
| 19. Serratus magnus, | 90 |
| 20. Deltoid, | 100 |
| 21. Coraco-brachialis, | 7 |
| 22. Biceps humeri, | 135 |
| 23. Brachialis anticus, | 50 |
| 24. Triceps, | 349 |

It is not my intention at present to enter upon a detailed examination of the action of the hip and knee joint muscles in this monkey. It is sufficient to notice that, although the positions and relations of the parts are so different from those of man, yet that the muscles admit of being divided into the same four antagonistic groups.

| | Grains. |
|---|---|
| 1. Posterior muscles of hip joint,<br>(glutæi and pyriformis.) | 638 |
| 2. Anterior muscles of hip joint,<br>(adductores, iliacus, and psoas magnus.) | 693 |
| 3. Extensors of knee joint, | 628 |
| 4. Flexors of knee joint, | 697 |
| | 2656 |

Converting these as before into percentages, we find—

| | |
|---|---|
| 1. Posterior muscles of hip joint, | 24·02 |
| 2. Anterior muscles of hip joint, | 26·10 |
| 3. Extensors of knee joint, | 23·64 |
| 4. Flexors of knee joint, | 26·24 |
| | 100·00 |

In this monkey, therefore, the four groups of muscles are of nearly equal force; whereas in man the last group is greatly below the first three in amount of force.

If we compare the os innominatum of this monkey with that of man, we find very striking differences, which may be seen from an examination of Fig. 5, which represents the outer aspect of this bone, on the right side of the body. This figure should be compared with Fig. 2, which represents the same bone in man.

The ilio-pectinæal and ilio-ischial lines are not formed by planes, but consist each of a broken line; they are at right angles to each other, as in man, in the lower portion of their course, but form an acute angle of 30° with each other in their course along the edges of the ilium.

The next monkey whose muscular anatomy I shall describe is the *Macacus.*

Fig. 5.

### TABLE III.—*Physical data. Macacus* (female).

#### (*a*) *Body and Viscera.*

| | Grains. | | Grains. |
|---|---|---|---|
| 1. Body, | 41,700 | 4. Heart, | 418 |
| 2. Kidneys, | 385 | 5. Brain, | 1210 |
| 3. Liver, | 1650 | 6. Intestines, stomach, and spleen, | 1584 |

#### (*b*) *Muscular System.*

| | Grains. |
|---|---|
| 1. Adductores femoris,<br>(triceps, adductor, and pectinæus.) | 462 |
| 2. Gracilis and sartorius,<br>(These two muscles are united at their point of attachment to the tubercle of the tibia, and the *gracilis* arises from the whole length of the symphysis pubis.) | 110 |
| 3. Psoas and iliacus, | 231 |
| 4. Glutæi, and small rotators, | 451 |
| 5. Flexors of knee:— | |
| Biceps femoris, | 396 |
| Semimembranosus and semitendinosus, | 231 |
| 6. Extensors of knee:— | |
| Quadriceps and tensor vaginæ, | 605 |

N. B.—The trachelo-acromius (No. 16 of last) is attached to the anterior third of the spine of the scapula, on its inner edge below the trapezius, and to the anterior fourth of the clavicle.

The accessory slip (No. 12 of last) passes from the semicircular ridge to a fibrous band running along the anterior half of the vertebral edge of the scapula. There is no distinct *levator anguli scapulæ;* it forms part of the *serratus magnus.*

Combining these muscles into the same four groups as before, we find—

| | Grains. | Per Cent. |
|---|---|---|
| 1. Posterior muscles of hip joint, | 451 | 18·98 |
| 2. Anterior muscles of hip joint, | 693 | 29·16 |
| 3. Extensors of knee joint, | 605 | 25·46 |
| 4. Flexors of knee joint, | 627 | 26·40 |
| | 2376 | 100·00 |

The distribution of the muscles is here very similar to that found in the Cercopithecus, and very different from that of man. In both cases the prominent point of difference is the feebleness of the flexor muscles of the knee joint in man.

The insertion of the trachelo-acromius (*16) into both clavicle and scapula, and not into the scapula only, would seem to be characteristic of the Macacus, as distinguished from the Cercopithecus.

I shall add, for the purpose of comparison with the foregoing, the weights of the muscles of a male Cercopithecus and Macacus.

---

* These muscles are numbered as in Table II.

## TABLE IV.—*Physical data. Cercopithecus* (male).

### (*a*) *Body and Viscera.*

| | Grains. | | Grains. |
|---|---|---|---|
| 1. Body, | 55,160 | 5. Kidneys, | 440 |
| 2. Brain, | 1265 | 6. Heart, | 358 |
| 3. Liver, | 2090 | 7. Lungs, | 798 |
| 4. Spleen, | 220 | 8. Stomach and intestines, | 3520 |

This fine monkey was formerly the property of Lord Massereene, and was presented to the Royal Zoological Gardens by Lady Massereene.

The brain showed an injury on left cerebral lobe, with meningitis and slight softening, and there was a scalp bruise over the seat of the internal injury; the lungs contained a few pneumonic spots in their upper portions. It was dissected in October, 1863.

### (*b*) *Posterior Muscles of Hip Joint and smaller Rotators.*

| | Grains. |
|---|---|
| Glutæi, pyriformis, &c., | 660 |

### (*c*) *Anterior Muscles of Hip Joint.*

| | |
|---|---|
| 1. Iliacus and two psoades, | 412 |
| 2. Adductores (viz. longus, magnus, and brevis), sartorius, and pectinæus, | 852 |
| 3. Gracilis, | 82 |

### (*d*) *Extensors of Knee Joint.*

| | |
|---|---|
| 1. Quadriceps extensor femoris, | 990 |
| 2. Tensor vaginæ femoris, | 28 |

### (*e*) *Flexors of Knee Joint.*

| | |
|---|---|
| Biceps, semimembranosus, and semitendinosus, | 495 |

### (*f*) *Other Muscles.*

| | |
|---|---|
| (*12) Accessory slip from the semicircular ridge to the lower point of trisection of inner side of vertebral edge of scapula (well developed). | |
| (*15) Levator anguli scapulæ, part of the serratus magnus, attached to the transverse processes of the seven cervical vertebræ, | 22 |
| (*16) Trachelo-acromion-levator, attached to the anterior third of the spine of the scapula, and not to the clavicle; proceeds from transverse process of the atlas (well developed). | |

## TABLE V.—*Physical data. Macacus* (male).

### (*a*) *Body and Viscera.*

| | Grains. | | Grains. |
|---|---|---|---|
| 1. Body, | 22,014 | 5. Kidneys, | 150 |
| 2. Brain, | 1093 | 6. Heart, | 180 |
| 3. Liver, | 910 | 7. Lungs, | 220 |
| 4. Spleen, | 110 | 8. Stomach and intestines, | 1590 |

Dissected in March, 1862.

### (*b*) *Posterior Muscles of Hip Joint.*

| | Grains. |
|---|---|
| 1. Glutæi, pyriformis, obturatores, and gemelli, . . . . . . | 280 |

### (*c*) *Anterior Muscles of Hip Joint.*

| | |
|---|---|
| 1. Iliacus and two psoades, . . . . . . . . . . . . . . . . | 120 |
| 2. Adductores, . . . . . . . . . . . . . . . . . . . . . . | 220 |

### (*d*) *Extensors of Knee Joint.*

| | |
|---|---|
| 1. Quadriceps femoris, . . . . . . . . . . . . . . . . . . | 160 |

### (*e*) *Flexors of Knee Joint.*

| | |
|---|---|
| 1. Biceps, semimembranosus, semitendinosus, (and gracilis), . | 270 |

### (*f*) *Other Muscles.*

| | |
|---|---|
| 1. Quadratus lumborum and sacrolumbalis, . . . . . . . . | 140 |
| 2. Triceps humeri, . . . . . . . . . . . . . . . . . . . . | 125 |
| 3. Latissimus dorsi, . . . . . . . . . . . . . . . . . . . . | 77 |
| (*12) Accessory slip (wanting). | |
| (*16) Trachelo-acromius, from transverse processes of atlas and axis, to the posterior edge of the outer third of the clavicle and spine of scapula,. . . . . . . . . . . . . . . . | 15 |

Sir W. R. Hamilton, LL. D., read a paper—

### On the Eight Imaginary Umbilicar Generatrices of a Central Surface of the Second Order.

He stated that he had been lately led, by quaternions, to perceive that the twelve known umbilics of such a surface are ranged on *eight imaginary right lines,* of which he has assigned the vector equations, and deduced a variety of properties.

J. Ribton Garstin, Esq., on behalf of Captain St. Vincent Hawkins Whitshed, presented a flat ornamented bronze celt, found near Tallaght, county of Dublin; also a piece of iron, which was believed to be part of an ancient celt.

The thanks of the Academy were voted to the donors.

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* These muscles are numbered as in Table II.

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## CORRIGENDA.

Page 409, *for* Dr. R. Keller, *read* Dr. F. Keller.
„ 457, line 23, *for* Ᵹꝺıll, *read* Ᵹoıll.
„ 458, „ 28, *for* Blythe, *read* Blyth.
„ 487, „ 10, *for* George B. Stoney, *read* George J. Stoney.
„ 487, Com. Pol. Lit., *insert* Rev. George Longfield, B. D.

END OF VOLUME VIII.